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Dark personalities and Bitcoin®: The influence of the Dark Tetrad on cryptocurrency attitude and buying intention

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ABSTRACT

Markets for cryptocurrencies such as Bitcoin have experienced tremendous growth. Yet little research has examined why people want to buy cryptocurrencies that are risky investments. The present research studies a subset of people interested in cryptocurrencies. Specifically, we examine the effect of Dark Tetrad traits (Machiavellianism, subclinical narcissism, subclinical psychopathy, and subclinical sadism) on a person's crypto attitude and buying intention. The following mediators were examined as reasons for people buying crypto: (1) conspiracy beliefs (e.g., distrust of government), (2) positivity and (3) fear of missing out (FoMO). Importantly, we are not suggesting all crypto buyers exhibit Dark Tetrad traits. Based on a pre-registered survey of the main research question rather than hypotheses (N = 566), it was found that narcissism was positively associated with crypto attitude which was mediated by positivity. Machiavellianism was associated with buying intention which was mediated by conspiracy beliefs. Machiavellians were more distrustful of government which was associated with a greater desire to buy crypto. Psychopathy affected crypto judgments through FoMO and a negative effect on positivity. Sadism is associated with FoMO and a lack of positivity which affects crypto judgments.

1. Introduction

The global cryptocurrency market has a total market value of over USD$2 trillion, with cryptocurrencies such as Bitcoin increasing in price by over 8000% in five years (Coinmarketcap.com 2021). Cryptocurrencies ("crypto") are digital currencies based on cryptography and blockchain technology. Crypto are traded on the internet through a peer-to-peer network that records transactions on a public blockchain, unlike fiat currencies which are government-issued. Currently, drivers of why people buy crypto are not well known. At first glance, crypto are a digital asset that offer potential capital gain from speculative risk. However, two features are worthy of note. First, crypto have extreme price volatility, their high-risk nature making crypto trading akin to gambling (Delfabbro, King, & Williams, 2021) with crypto trading appealing to gamblers (Mills & Nower, 2019). Second, crypto are decentralized and global. They are not backed by governments. We posit that this price volatility (i.e., potential gain) and autonomy from government oversight make crypto attractive to that subset of crypto buyers who are prone to gambling and are suspicious of government. Thus, the present research examines effects of the Dark Tetrad on crypto judgments. We are *not* suggesting all crypto buyers have Dark Tetrad traits. Further, we study three mediators underlying these effects - conspiracy beliefs, Fear of Missing Out (FoMO), and positivity.

1.1. Dimensions of the Dark Tetrad

The Dark Tetrad involves the Dark Triad of antisocial personality traits (Machiavellianism, narcissism, psychopathy, Paulhus & Williams, 2002) and sadism (Buckels, Jones, & Paulhus, 2013). Machiavellianism is characterized by a manipulative approach towards others (Paulhus & Williams, 2002). Machiavellians take a calculated approach to achieve goals, avoid impulsive decisions and tend not to engage in problem gambling (Onyedire et al., 2021). Thus, it may seem that they would not be interested in a risky cryptocurrency. Sekścińska and Rudzinska-

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Wojciechowska (2020) found that although Machiavellianism was correlated with financial risk-taking (r = 0.25), subsequent studies showed no relationship with financial risk-taking (e.g., stocks) and gambling risks. However, we posit that the high returns of the crypto market may encourage Machiavellians to buy as they tend to be money-obsessed (Engelberg & Sjöberg, 2007) and make reward-oriented decisions in gambling (Birkás, Csathó, Gács, & Bereczkei, 2015; Błachnio & Przepiórka, 2018). Thus, Machiavellianism should be positively associated with cryptocurrency judgments.

We predict the effect of Machiavellianism on crypto judgments will be mediated by conspiracy beliefs. March and Springer (2019) found Machiavellianism was positively associated with government conspiracy beliefs (r = 0.67). Similarly, Kay (2021) showed how Machiavellians' distrust of others was associated with conspiracist ideation. Hughes and Machan (2021) also found Machiavellianism was positively associated with COVID conspiracy beliefs. Regarding FoMO, this is defined as "a pervasive apprehension that others might be having rewarding experiences from which one is absent" (Przybylski, Murayama, DeHaan, & Gladwell, 2013). For our research, this is FoMO on crypto investing rewards that others are experiencing. Delfabbro et al. (2021) assert that FoMO is "one of the strongest psychological factors" for crypto trading because investors can see massive returns online in a 24-hour trading market. Machiavellianism is associated with affective responses from social comparison (Lange, Paulhus, & Crusius, 2018) and has been found to be positively correlated with FoMO (r = 0.32, Servidio, Griffiths, & Demetrovics, 2021). Thus, FoMO should mediate the effect of Machiavellianism on crypto judgments. Regarding positivity, Machiavellianism - with its cold, cynical perspective - has been found to be unrelated or to a lesser extent, negatively associated with positive affect (Jonason & Jackson, 2016; Limone, Sinatra, & Monacis, 2020; Pilch, 2020). Therefore, positivity should not mediate the effect of Machiavellianism on crypto judgments.

Narcissism is characterized by self-aggrandizement and grandiosity (Paulhus & Williams, 2002). We believe narcissism would be positively associated with crypto investing. Narcissism has been found to be related to risky stock market investing (Foster, Reidy, Misra, & Goff, 2011; Sekścińska & Rudzinska-Wojciechowska, 2020). Thus, risky crypto should appeal to narcissists. For mediators, we expect narcissism to be associated with conspiracy beliefs. Kay (2021) found that narcissism is associated with conspiracist ideation. Recent research shows that narcissism accounts for 4% (Bowes, Costello, Ma, & Lilienfeld, 2021) and 4.9% (Ahadzadeh, Ong, & Wu, 2021) in the variance in conspiracy beliefs. Thus, it is plausible that conspiracy beliefs mediate the effect of narcissism on crypto judgments. Further, research indicates that FoMO mediates the effect of narcissism on smartphone addiction (Servidio et al., 2021). Błachnio and Przepiórka (2018) also found that narcissism and FoMO were positively associated with an excessive use of social media. However, these results may represent impression management (e.g., narcissists' self-presentation on social media) rather than FoMO about investment returns. Thus, we do not expect the effect of narcissism on crypto attitudes to be mediated by FoMO. For positivity, narcissists have agentic self-views, are overconfident and are more willing to take risks (Campbell, Goodie, & Foster, 2004; Joshanloo, 2021). Narcissists' overconfidence is associated with more gambling (Lakey, Rose, Campbell, & Goodie, 2008). Further, the positive effect on narcissism on risky stock market investing has been linked to an approach motivation (Foster et al., 2011). Thus, we predict that positivity mediates the effect of narcissism on crypto attitudes.

Psychopathy is characterized by callous, impulsive antisocial behavior (Paulhus, 2014). The reckless nature of psychopaths paired with a tendency to experience low levels of stress and anxiety and a desire to seek stimulation (Jauk & Dieterich, 2019) makes them natural online gamblers. Research indicates that psychopathy is associated with problematic online gambling and gaming addiction (Jauk & Dieterich, 2019; Tang, Reer, & Quandt, 2020; Servidio, Griffiths, & Demetrovics, 2021). We predict that psychopaths would be willing to buy crypto. For mediation, psychopathy has been associated with COVID conspiracy beliefs (Hughes & Machan, 2021; Kay, 2021). The impulsivity of psychopaths (Paulhus, 2014) may lead them to experience crypto FoMO. Yet psychopathy is negatively associated with positive affect (Joshanloo, 2021). Thus, we predict that the effect of psychopathy on crypto judgments is mediated by conspiracy beliefs and FoMO, but not positivity.

Everyday sadism relates to enjoying another's suffering (Buckels et al., 2013; Foulkes, 2019). Sadism has been found to be associated with behavior in a digital context. For instance, sadists troll others on the Internet for enjoyment (Buckels, Trapnell, Andjelovic, & Paulhus, 2019; Buckels, Trapnell, & Paulhus, 2014). However, as sadism involves pleasure from another's pain and buying crypto is unlikely to directly result in another's distress, we do not expect an association between sadism and crypto judgments.

2. Method

2.1. Participants and procedure

Participants were drawn from Prolific Academic. The study was approved by the Ethical Committee of Cardiff University (Number 2021080) and started in July 2021. Data collection was in two waves. In the first wave (N = 907; females = 69.8%; mean age = 32.4 years; SD = 12.3) participants reported their awareness of cryptocurrency and their interest in investing in financial assets. Participants that reported being aware of cryptocurrency, interested in investing, agreeing to participate in a follow up survey, reporting a valid ID (N = 601), were invited after two days to participate in the main study (N = 566; females = 63.3%; mean age = 31.1 years; SD = 11.3; return rate = 94.2%). Table 1 displays sample characteristics. The Supplementary Material provides sample descriptive statistics.

The sample size was checked in terms of statistical power for model testing. A priori power analyses using the G*Power tool was used to determine the adequacy of the sample size (Faul, Erdfelder, Buchner, & Lang, 2009). Using suggested minimum values by Cohen (1988, a minimum R^2 value of 0.10, a statistical power of 80%, and 4 predictors), the a priori G*Power calculation indicated that a sample size of 125 would be required. The post-hoc G*Power calculation for a minimum R^2 value of 0.10, and with the same predictors, indicated that the statistical power achieved using the study's final sample of 566 was 99%, which is well above Cohen's (1988) recommendations. Therefore, the final sample size was adequate for testing the proposed model (Fig. 1).

2.2. Measures

This section presents the measures used in the main questionnaire. Internal consistency and means are presented in Table 2, items and descriptive measures appear in the Supplementary Material.

2.2.1. Dependent measures

Attitude towards cryptocurrency was assessed with three items (bad/good, unfavorable/favorable, and negative/positive) adapted from Martin, Zhan, Wang, and Jin (2019). Buying intention was assessed with three items (unlikely/likely, unfavorable/favorable, and negative/positive) adapted from Martin and Strong (2016). All items were measured on a 7-point scale.

2.2.2. Independent measures

We assessed the Short Dark Triad (SD3) based on Jones and Paulhus (2014). The scale consists of three constructs: Machiavellianism (9 items), narcissism (9 items), and psychopathy (9 items). All items were measured an a 5-point agreement scale (1 = strongly disagree; 5 = strongly agree). Sadism was measured based on the assessment of Sadistic Personality Scale (ASP, 9 items) by Plouffe, Saklofske, and Smith (2017). The items were measured on a 5-point agreement scale (1 = strongly disagree; 5 = strongly agree).

Table 1
Sample background (N = 566).

	N (%)		N (%)
Gender (%)		Are you aware of cryptocurrency? (%)	
Male	200 (35.3)	Yes	566 (100.0)
Female	358 (63.3)	No	0 (0.0)
Non-binary/third gender	5 (0.9)	Are you interested in investing in stocks, bonds, or cryptocurrency? (%)	
I do not want to answer	3 (0.5)	Yes	283 (50.0)
Mean age (SD)	31.13 (11.31)	Maybe	283 (50.0)
Education (%)		No	0 (0.0)
Primary school	0 (0.0)	What is your experience in investing in stocks, bonds, or cryptocurrency? (%)	
Prost primary school	27 (4.8)	Never	254 (44.9)
Further education	153 (27.0)	Less than a year	157 (27.7)
Undergraduate higher education	291 (51.4)	1–5 years	114 (20.1)
Professional education	80 (14.1)	6–10 years	24 (4.2)
Doctorate	15 (2.7)	11–15 years	6 (1.1)
Marital status (%)		16–20 years	6 (1.1)
Single	287 (50.7)	More than 20 years	5 (0.9)
Married	147 (26.0)	Do you own any cryptocurrency? (%)	
Cohabiting	119 (21.0)	Yes	147 (26.0)
Divorced	10 (1.8)	No	419 (74.0)
Widowed	3 (0.5)	[If no] Would you be interested in investing in cryptocurrency? (%)	
Annual income (%)		Yes	267 (63.7)
Less than £10,000	162 (28.6)	No	152 (36.3)
£10,000–£19,999	128 (22.6)		
£20,000–£29,999	125 (22.1)		
£30,000–£39,999	68 (12.0)		
£40,000–£49,999	42 (7.4)		
More than £50,000	41 (7.2)		

2.2.3. *Mediators*

Fear of Missing Out (FoMO) was measured with a scale adapted from Hall, Steele, Christofferson, and Mihailova (2021) and Przybylski et al. (2013). The scale measured four items on a 5-point scale (1 = never; 5 = always). Positivity was assessed with a scale adapted from Caprara et al. (2012). The scale measured eight items on a 5-point agreement scale (1 = strongly disagree; 5 = strongly agree). Conspiracy beliefs were assessed with the conspiracy mentality questionnaire (Bruder, Haffke, Neave, Nouripanah, & Imhoff, 2013). The scale consisted of five items measured on an 11-point scale (1 = 0% certainly not; 11 = 100% certain).

2.2.4. *Other measures*

A question was included addressing participants' experience with investing in financial assets adapted from Puustinen, Maas, and Karjaluoto (2013), current cryptocurrency ownership, and their interest in investing in cryptocurrency in case they did not own any.

2.2.5. *Statistical analysis*

Our analysis followed the study's pre-registered protocol which registered the main research question but not hypotheses (https://aspredicted.org/pj9q7.pdf). Descriptive analysis and correlations were performed with SPSS version 27. The path model was produced with SmartPLS 3 (Ringle, Wende, & Becker, 2015), using the consistent PLS (PLSc) algorithm. PLSc is recommended when all latent constructs in the model are reflective, while estimates are comparable to those obtained from covariance-based structural equation modeling (Dijkstra & Henseler, 2015).

3. Results

3.1. *Correlations*

Table 2 presents variable intercorrelations. With an exception between buying intentions and attitudes, correlation coefficients are low to moderate. Correlations were positive, except for significant negative correlations between positivity and Machiavellianism, positivity and psychopathy, positivity and sadism, and positivity and conspiracy beliefs.

3.2. *Path model*

3.2.1. *Measurement model validation and model fit*

Item loadings for some constructs were low (e.g., psychopathy, positivity). From a visual inspection, the majority were for reversed items (i.e., scores after reversal still resulted in low correlations). The average variance extracted for narcissism, psychopathy, and sadism are below the recommended threshold (>0.50). Nevertheless, given that the composite reliability is well above the recommended level (>0.70) and the scales have a strong theoretical base, we consider the internal reliability of the measurement items is acceptable (Fornell & Larcker, 1981). The table provides the scores of the heterotrait-monotrait ratio of correlations (HTMT) that is used to assess discriminant validity. Discriminant validity has been established since all scores are below the threshold (<0.90). Such approach is superior to the Fornell-Larcker criterion that is traditionally used (Henseler, Ringle, & Sarstedt, 2015).

The Stone-Geisser Q^2 values obtained through the blindfolding procedures for attitude ($Q^2 = 0.031$), buying intention ($Q^2 = 0.033$), conspiracy beliefs ($Q^2 = 0.016$), FoMO ($Q^2 = 0.063$), and positivity ($Q^2 = 0.119$) were larger than zero, supporting the predictive relevance of the model (Hair, Hult, Ringle, & Sarstedt, 2017). Finally, the standardized root mean square residual value for the saturated structural model was 0.071, which was below the threshold of 0.08 that indicates a good model fit (Hair, Hult, Ringle, & Sarstedt, 2017).

3.2.2. *Structural model results*

Table 3 presents the path estimates of the model. Of the Dark Tetrad traits, Machiavellianism has a significant positive effect on conspiracy beliefs (b = 0.17) and FoMO (b = 0.13), narcissism has a significant positive effect on positivity (b = 0.45). Psychopathy has a significant positive effect on FoMO (b = 0.14) and a negative effect on positivity (b = −0.26). Sadism has significant positive effect on FoMO (b = 0.13) and a negative effect on positivity (b = −0.13). Considering the mediators, positivity had a positive significant effect on attitude (b = 0.10), conspiracy beliefs a positive significant effect on attitude (b = 0.10) and buying intention (b = 0.13), and FoMO a positive significant effect on attitude (b = 0.14) and buying intention (b = 0.14). Table 4 displays path estimates for the indirect effects of the model. We repeated the analysis controlling for experience and current ownership. In both cases, the results did not yield any significant differences (see Supplementary Material).

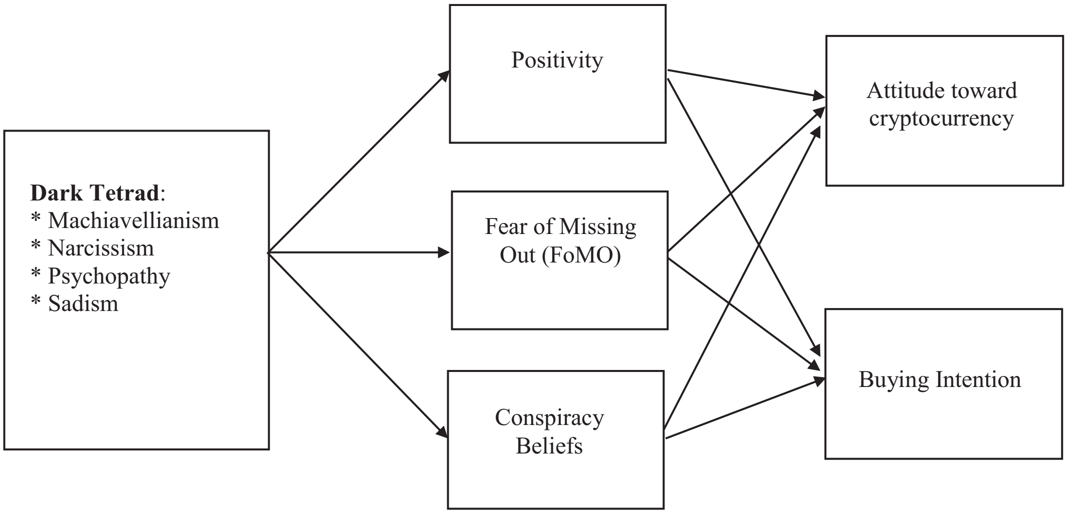

Fig. 1. Conceptual model.

Table 2
Descriptive statistics and Pearson correlations between variables.

	α	Mean (SD)	1	2	3	4	5	6	7	8
1. Attitude	0.95	4.53 (1.47)								
2. Buying intention	0.97	4.17 (1.79)	0.79**							
3. Machiavellianism	0.77	3.07 (0.64)	0.17**	0.11*						
4. Narcissism	0.74	2.51 (0.61)	0.12**	0.11*	0.30**					
5. Psychopathy	0.74	2.05 (0.61)	0.14**	0.14**	0.47**	0.34**				
6. Sadism	0.83	1.59 (0.63)	0.10*	0.11**	0.38**	0.22**	0.61**			
7. Fear of missing out	0.87	1.86 (0.90)	0.14**	0.14**	0.22**	0.05	0.24**	0.23**		
8. Positivity	0.86	3.43 (0.73)	0.06	0.01	−0.09*	0.30**	−0.21**	−0.22**	−0.19**	
9. Conspiracy beliefs	0.84	7.11 (1.78)	0.10*	0.14**	0.16**	0.09*	0.06	0.02	0.09*	−0.09*

Notes: All variables are measured on a 5-point scale, except for attitude and buying intention (7-point) and conspiracy beliefs (11-point).

** $p < 0.01$

* $p < 0.05$.

Table 3
Path estimates for main effects of the model.

Path	Path coefficient	*t*-test	p-value	CI 97.5%
Machiavellianism → conspiracy beliefs	0.17	3.60	0.000	0.08–0.26
Machiavellianism → fear of missing out	0.13	2.60	0.009	0.03–0.23
Machiavellianism → positivity	−0.05	1.12	0.264	−0.14–0.04
Narcissism → conspiracy beliefs	0.07	1.38	0.168	−0.03–0.15
Narcissism → fear of missing out	−0.06	1.30	0.193	−0.14–0.03
Narcissism → positivity	0.45	11.15	0.000	0.37–0.53
Psychopathy → conspiracy beliefs	−0.02	0.37	0.708	−0.13–0.08
Psychopathy → fear of missing out	0.14	2.41	0.016	0.02–0.25
Psychopathy → positivity	−0.26	5.10	0.000	−0.36–−0.16
Sadism → conspiracy beliefs	−0.03	0.48	0.632	−0.13–0.08
Sadism → fear of missing out	0.13	2.11	0.035	0.00–0.24
Sadism → positivity	−0.13	2.81	0.005	−0.23 to −0.04
Positivity → attitude	0.10	2.43	0.015	0.02–0.18
Positivity → buying intention	0.05	1.17	0.244	-0.04–0.13
Conspiracy beliefs → attitude	0.10	2.32	0.020	0.02–0.18
Conspiracy beliefs → buying intention	0.13	2.96	0.003	0.04–0.21
Fear of missing out → attitude	0.14	3.66	0.000	0.07–0.22
Fear of missing out → buying intention	0.14	3.32	0.001	0.05–0.22

4. Discussion

Why do people buy cryptocurrency? Despite the tremendous growth of the crypto market, this is unknown. Our research aimed to provide insight into this issue by studying an extreme subset of crypto consumers. Specifically, we studied effects of the Dark Tetrad on a person's crypto judgments and three potential mediators: (1) conspiracy beliefs, (2) positivity, and (3) fear of missing out (FoMO). Our results showed that effect of narcissism on crypto attitude was mediated by positivity. Machiavellianism was associated with buying intention mediated by conspiracy beliefs. The effects of psychopathy and sadism on crypto judgments were influenced by FoMO and a negative effect on positivity.

Narcissism was related to a favorable crypto attitude which was mediated by positivity which supports the positive approach narcissists take to risky investments (Foster et al., 2011). FoMO did not predict attitudes for narcissism but surprisingly, conspiracy beliefs were not a mediator. Although narcissism is associated with conspiracy ideation (Kay, 2021), it may be that conspiracy beliefs are not salient or diagnostic when narcissists consider crypto investments. Narcissism was not related to buying intention. Crypto buying intention was explained by Machiavellianism. Building on recent research (Hughes & Machan, 2021; Kay, 2021), Machiavellianism was associated with conspiracy beliefs. Thus, conspiracy beliefs appear to be a key construct to consider for Machiavellianism and crypto investment. Cunning Machiavellians take a distrustful view of government which in turn, drives their desire for crypto. Researchers should realize how the distrust of politicians can actively drive buying intention for non-government backed investments for Machiavellian investors. FoMO also mediated the effects for

Table 4
Path estimates for indirect effects of the model.

Path	Path Coefficient	t-test	p-value	CI 97.5%
Machiavellianism → conspiracy beliefs → attitude	0.02	1.79	0.074	0.00–0.04
Machiavellianism → conspiracy beliefs → buying intention	0.02	2.19	0.029	0.01–0.05
Machiavellianism → Fear of Missing Out → attitude	0.02	1.89	0.058	0.00–0.04
Machiavellianism → Fear of Missing Out → buying intention	0.02	1.90	0.058	0.00–0.04
Machiavellianism → positivity → attitude	−0.01	0.98	0.328	−0.02–0.01
Machiavellianism → positivity → buying intention	0.00	0.68	0.500	−0.01–0.00
Narcissism → conspiracy beliefs → attitude	0.01	1.12	0.262	−0.01–0.02
Narcissism → conspiracy beliefs → buying intention	0.01	1.18	0.239	−0.01–0.03
Narcissism → Fear of Missing Out → attitude	−0.01	1.18	0.238	−0.03–0.01
Narcissism → Fear of Missing Out → buying intention	−0.01	1.15	0.251	−0.03–0.01
Narcissism → positivity → attitude	0.04	2.37	0.018	0.01–0.09
Narcissism → positivity → buying intention	0.02	1.15	0.250	−0.02–0.07
Psychopathy → conspiracy beliefs → attitude	0.00	0.34	0.731	−0.02–0.01
Psychopathy → conspiracy beliefs → buying intention	0.00	0.36	0.721	−0.02–0.02
Psychopathy → Fear of Missing Out → attitude	0.02	1.96	0.050	0.00–0.04
Psychopathy → Fear of Missing Out → buying intention	0.02	1.96	0.050	0.00–0.04
Psychopathy → positivity → attitude	−0.03	2.24	0.025	−0.05–0.00
Psychopathy → positivity → buying intention	−0.01	1.14	0.253	−0.04–0.01
Sadism → conspiracy beliefs → attitude	0.00	0.43	0.666	−0.02–0.01
Sadism → conspiracy beliefs → buying intention	0.00	0.45	0.654	−0.03–0.01
Sadism → Fear of Missing Out → attitude	0.02	1.79	0.074	0.00–0.04
Sadism → Fear of Missing Out → buying intention	0.02	1.64	0.101	0.00–0.04
Sadism → positivity → attitude	−0.01	1.74	0.082	−0.03–0.00
Sadism → positivity → buying intention	−0.01	1.02	0.310	−0.02–0.01

Machiavellians.

Impulsive psychopaths felt FoMO which was related to more favorable crypto judgments. Psychopathy was also negatively associated with positivity which supports Joshanloo (2021). Similarly, sadism was negatively associated with positivity. Prior research shows that sadists experience positive affect where they harm others (Buckels et al., 2019). However, for crypto investing which is outside of an interpersonal context, the relationship between sadism and positivity is negative. Sadism was also related to FoMO which extends prior research showing that Dark Triad traits are positively related to FoMO (Servidio et al., 2021).

5. Limitations and future research

The present research had several limitations and research avenues. Our correlational study could provide causal insights with an experimental design. Our research could also have measured attitude or intention of engaging in other types of investment schemes as a control variable. Future research may explore additional mediators (e.g., envy). Would Dark Tetrad personalities trade crypto because of benign or malicious envy of another person's trading success? Finally, future research could study what triggers FoMO for Machiavellians in crypto trading (e.g., social comparison of large returns).

6. Conclusion

There has been a massive growth in cryptocurrency markets. Studying cryptocurrency through the lens of the Dark Tetrad offers insight into why people want to buy crypto. Importantly, we are *not* suggesting all crypto buyers exhibit Dark Tetrad traits. Instead, we are studying a subset of people interested in crypto who do have these traits. Our results show that narcissists like crypto which is based on positivity. Psychopaths and sadists fear missing out on investing rewards but lack positivity about their prospects. Machiavellians want to buy crypto because of their beliefs about politicians and government agencies.

CRediT authorship contribution statement

Brett A.S. Martin: Conceptualization, Writing – original draft, Writing – review & editing. **Polymeros Chrysochou:** Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Carolyn Strong:** Conceptualization, Writing – original draft. **Di Wang:** Conceptualization, Writing – original draft. **Jun Yao:** Conceptualization, Writing – original draft.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2021.111453.

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